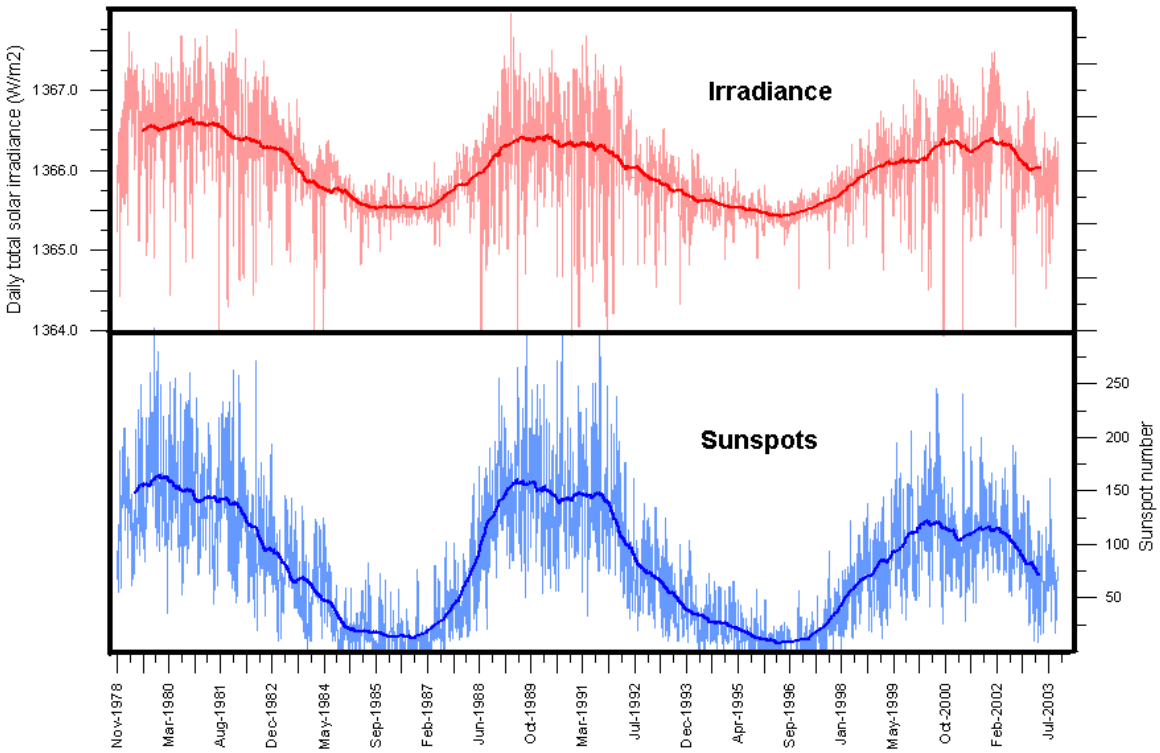

Solar irradiance and sunspot number since January 1979 according to NOAA's National Geophysical Data Canter (NGDC). The thin lines indicate the daily irradiance (red) and sunspot number (blue), while the thick lines indicate the running annual average for these two parameters. The total variation in solar irradiance is about 1.3 watts per square meter during one sunspot cycle. The solar irradiance data obtained by the ACRIM satellite, measures the total number of watts of sunlight that strike Earth's upper atmosphere before being absorbed by the atmosphere and ground.

Problem 1 - About what is the average value of the solar irradiance between 1978 and 2003?

Problem 2 - What appears to be the relationship between sunspot number and solar irradiance?

Problem 3 - A homeowner built a solar electricity (photovoltaic) system on his roof in 1985 that produced 3,000 kilowatts-hours of electricity that year. Assuming that the amount of ground-level solar power is similar to the ACRIM measurements, about how much power did his system generate in 1989?

Answer Key

Problem 1 - About what is the average value of the solar irradiance between 1978 and 2003? Answer: Draw a horizontal line across the upper graph that is mid-way between the highest and lowest points on the curve. An approximate answer would be 1366.3 watts per square meter.

Problem 2 - What appears to be the relationship between sunspot number and solar irradiance? Answer: What there are a lot of sunspots on the sun (called sunspot maximum) the amount of solar radiation is higher than when there are fewer sunspots, and the solar irradiance changes follow the 11-year sunspot cycle.

Problem 3 - A homeowner built a solar electricity (photovoltaic) system on his roof in 1985 that produced 3,000 kilowatts-hours of electricity that year. Assuming that the amount of ground-level solar power is similar to the ACRIM measurements, about how much power did his system generate in 1989? Answer: In 1985, the amount of insolation was about 1365.5 watts per square meter when the photovoltaic system was built. In 1989 the insolation increased to about 1366.5 watts per square meter. This insolation change was a factor of 1366.5/1365.5 = 1.0007 .That means that by scaling, if the system was generating 3,000 kilowatt-hours of electricity in 1985, it will have generated 1.0007 x 3,000 kWh = 2 kWh more in 1989 during sunspot maximum! That is equal to running one 60-watt bulb for about 1 day (actually 33 hours).